CLAIMS

1. A method of increasing the functionality of the bone marrow of a patient, comprising disrupting sex steroid-mediated signaling in the patient, wherein said bone marrow functionality is increased without, prior to, or concurrently with, reactivation of the patient's thymus.

2. A method for preventing illness or disease in a patient, comprising disrupting sex steroid-mediated signaling in the patient, wherein the functionality of the bone marrow of the patient is increased without, prior to, or concurrently with, reactivation of the patient's thymus, and wherein clinical symptoms of the disease are reduced as compared to those symptoms that would have otherwise occurred in a patient prior to disruption of sex steroid-mediated signaling in the patient.

3. The method of claim 1 or 2, wherein HSC haemopoiesis is increased.

4. The method of claim 1 or 2, wherein HSC output from the bone marrow is increased.

5. The method of claim 1 or 2, wherein the sex steroid-mediated signaling is disrupted by castration.

6. The method of claim 5, wherein the sex steroid-mediated signaling is disrupted by surgical castration.

7. The method of claim 6, wherein the sex steroid-mediated signaling is disrupted by chemical castration.

8. The method of claim 1 or 2, wherein the sex steroid-mediated signaling is disrupted by administration of one or more pharmaceuticals.

9. The method of claim 8, wherein the one or more pharmaceuticals is selected from the group consisting of LHRH agonists, LHRH antagonists, anti-LHRH vaccines, anti-androgens, anti-estrogens, SERMs, SARMs, SPRMs, ERDs, aromatase inhibitors, anti-progestogens, and combinations thereof.

10. The method of claim 9, wherein the LHRH agonists are selected from the group consisting of Eulexin, Goserelin, Leuprolide, Dioxalan derivatives, Triptorelin, Meterelin, Buserelin, Histrelin, Nafarelin, Lutrelin, Leuprorelin, Deslorelin, Cystorelin, Decapeptyl, Gonadorelin, and combinations thereof.

11. The method of claim 9, wherein the LHRH antagonists are selected from the group consisting of Abarelix, Cetrorelix, and combinations thereof.

12. The method of claim 9, wherein the anti-androgen is Cosudex®.

13. The method of claim 1 or 2, wherein the thymus of the patient has been at least in part atrophied.

14. The method of claim 13, wherein the patient has a disease or illness that at least in part atrophied the thymus of the patient.

15. The method of claim 13, wherein the patient has had a treatment of a disease or illness that at least in part atrophied the thymus of the patient.

16. The method of claim 15, wherein the treatment is immunosuppression, chemotherapy, or radiation treatment.

17. The method of claim 13, wherein the patient is post-pubertal.

18. The method of claim 14, further comprising administering cells to the patient, wherein the cells are stem cells, progenitor cells, or combinations thereof.

19. The method of claim 18, wherein the stem cells are selected from the group consisting of HSC, epithelial stem cells, and combinations thereof.

20. The method of claim 18, wherein the progenitor cells are selected from the group consisting of lymphoid progenitor cells, myeloid progenitor cells, and combinations thereof.

21. The method of claim 19, wherein the progenitor cells are selected from the group consisting of lymphoid progenitor cells, myeloid progenitor cells, and combinations thereof.

22. The method of claim 19, wherein the cells are HSC.

23. The method of claim 22, wherein the HSC are CD34+.

24. The method of claim 22, wherein the HSC are autologous.

25. The method of claim 22, wherein the HSC are not autologous.

26. The method of claim 22, wherein the HSC are administered at the time disruption of sex steroid-mediated signaling is begun.

27. The method of claim 2, wherein the disease or illness is caused by an agent selected from the group consisting of viruses, bacteria, fungi, parasites, prions, cancers, allergens, asthma-inducing agents, and self proteins and antigens which cause autoimmune disease.

28. The method of claim 27, wherein the agent is a virus.

29. The method of claim 28, wherein the virus is selected from the group consisting of Retroviridae, Picornaviridae, Calciviridae, Togaviridae, Flaviridae, Coronaviridae, Rhabdoviridae, Filoviridae, Paramyxoviridae, Orthomyxoviridae, Bungaviridae, Arenaviridae, Reoviridae, Birnaviridae, Hepadnaviridae, Parvoviridae, Papovaviridae, Adenoviridae, Herpesviridae, Poxviridae, and Iridoviridae.

30. The method of claim 28, wherein the virus is selected from the group consisting of influenza virus, human immunodeficiency virus, and herpes simplex virus.

31. The method of claim 27, wherein the agent is a bacteria.

32. The method of claim 31, wherein the bacteria is selected from the group consisting of *Helicobacter pyloris, Borelia burgdorferi, Legionella pneumophilia, Mycobacteria tuberculosis, Mycobacteria. avium, Mycobacteria intracellulare, Mycobacteria kansaii, Mycobacteria gordonae, Mycobacteria* sporozoites, *Staphylococcus aureus, Neisseria gonorrhoeae, Neisseria meningitidis, Listeria monocytogenes, Streptococcus pyogene, Streptococcus agalactiae, Streptococcus faecalis, Streptococcus bovis, Streptococcus pneumoniae*, pathogenic *Campylobacter* sporozoites, *Enterococcus* sporozoites, *Haemophilus influenzae, Bacillus antracis, Corynebacterium diphtheriae, Corynebacterium* sporozoites, *Erysipelothrix rhusiopathiae, Clostridium perfringens, Clostridium tetani, Enterobacter aerogenes, Klebsiella pneumoniae, Pasturella multocida, Bacteroides* sporozoites, *Fusobacterium nucleatum, Streptobacillus moniliformis, Treponema pallidium, Treponema pertenue, Leptospira*, and *Actinomyces israelli.*

33. The method of claim 31, wherein the bacteria is a mycobacteria.

34. The method of claim 27, wherein the agent is a parasite.

35. The method of claim 32, wherein the parasite is selected from the group consisting of *Plasmodium falciparum, Plasmodium yoelli,* and *Toxoplasma gondii.*

36. The method of claim 34, wherein the parasite is a malaria parasite.

37. The method of claim 27, wherein the agent is an infectious fungi.

38. The method of claim 37, wherein the infectious fungi is selected from the group consisting of *Cryptococcus neoformans, Histoplasma capsulatum, Coccidioides immitis, Blastomyces dermatitidis, Chlamydia trachomatis, Candida albicans.*

39. The method of claim 27, wherein the agent is a cancer.

40. The method of claim 30, wherein the cancer is selected from the group consisting of cancers of the brain, cancers of the lung, cancers of the ovary, cancers of the breast, cancers of the prostate, cancers of the colon, and cancers of the blood.

41. The method of claim 27, wherein the agent is an allergen.

42. The method of claim 31, wherein the allergen causes an allergic condition selected from the group consisting of eczema, allergic rhinitis, allergic coryza, hay fever, bronchial asthma, urticaria (hives), and food allergies.

43. The method of claim 27, wherein the patient was exposed to the agent prior to the disruption of sex steroid-mediated signaling in the patient.

44. The method of claim 27, wherein the patient was not exposed to the agent prior to the disruption of sex steroid-mediated signaling in the patient.

45. The method of claim 27, further comprising administering at least one cytokine, at least one growth factor, or a combination of at least one cytokine and at least one growth factor to the patient.

46. The method of claim 45, wherein the cytokine is selected from the group consisting of Interleukin 2 (IL-2), Interleukin 7 (IL-7), Interleukin 15 (IL-15), stem cell factor (SCF), and combinations thereof.

47. The method of claim 45, wherein the growth factor is selected from the group consisting of members of the epithelial growth factor family, members of the fibroblast growth factor family, Stem Cell Factor (SCF), granulocyte colony stimulating factor (G-CSF), keratinocyte growth factor (KGF), granulocyte-macrophage colony stimulating factor (GM-CSF), and combinations thereof.

48. The method of claim 46, wherein the growth factor is selected from the group consisting of members of the epithelial growth factor family, members of the fibroblast

growth factor family, Stem Cell Factor (SCF), granulocyte colony stimulating factor (G-CSF), keratinocyte growth factor (KGF), granulocyte-macrophage colony stimulating factor (GM-CSF), and combinations thereof.

49. A method of enhancing HSC engraftment in recipient patient, comprising:

disrupting sex steroid-mediated signaling in the patient;

administering HSC to the patient; and

allowing HSC engraftment in the patient's bone marrow,

wherein said HSC engraftment is enhanced without, prior to, or concurrently with reactivation of the patient's thymus.

50. A method for preventing disease or illness in a patient, comprising:

disrupting sex steroid-mediated signaling in the patient;

administering HSC to the patient; and

allowing HSC engraftment in the patient's bone marrow,

wherein the HSC engraftment is enhanced without, prior to, or concurrently with thymus reactivation, and wherein clinical symptoms of the disease or illness are reduced as compared to those symptoms that would have otherwise occurred in a patient prior to disruption of sex steroid-mediated signaling in the patient.

51 The method of claim 49 or 50, wherein said HSC are autologous.

52. The method of claim 49 or 50, wherein said HSC are not autologous.

53. The method of claim 49 or 50, wherein the sex steroid-mediated signaling is disrupted by castration.

54. The method of claim 53, wherein the sex steroid-mediated signaling is disrupted by surgical castration.

55. The method of claim 54, wherein the sex steroid-mediated signaling is disrupted by chemical castration.

56. The method of claim 49 or 50, wherein the sex steroid-mediated signaling is disrupted by administration of one or more pharmaceuticals.

57. The method of claim 56, wherein the one or more pharmaceuticals is selected from the group consisting of LHRH agonists, LHRH antagonists, anti-LHRH vaccines, anti-androgens, anti-estrogens, SERMs, SARMs, SPRMs, ERDs, aromas inhibitors, anti-progestogens, and combinations thereof.

58. The method of claim 57, wherein the LHRH agonists are selected from the group consisting of Eulexin, Goserelin, Leuprolide, Dioxalan derivatives, Triptorelin, Meterelin, Buserelin, Histrelin, Nafarelin, Lutrelin, Leuprorelin, Deslorelin, Cystorelin, Decapeptyl, Gonadorelin, and combinations thereof.

59. The method of claim57, wherein the LHRH antagonists are selected from the group consisting of Abarelix, Cetrorelix, and combinations thereof.

60. The method of claim 57, wherein the anti-androgen is Cosudex®.

61. The method of claim 49 or 50, wherein the thymus of the patient has been at least in part atrophied.

62. The method of claim 61, wherein the patient has a disease or illness that at least in part atrophied the thymus of the patient.

63. The method of claim 61, wherein the patient has had a treatment of a disease or illness that at least in part atrophied the thymus of the patient.

64. The method of claim 63, wherein the treatment is immunosuppression, chemotherapy, or radiation treatment.

65. The method of claim 61, wherein the patient is post-pubertal.

66. The method of claim 62, further comprising administering lymphoid progenitor cells, myeloid progenitor cells, epithelial stem cells, or combinations thereof to the patient.

67. The method of claim 49 or 50wherein the HSC are CD34+.

68. The method of claim 49 or 50, wherein the HSC are administered at the time disruption of sex steroid-mediated signaling is begun.

69. The method of claim 50, wherein the disease or illness is caused by an agent selected from the group consisting of viruses, bacteria, fungi, parasites, prions, cancers, allergens, asthma-inducing agents, and self proteins and antigens which cause autoimmune disease.

70. The method of claim 69, wherein the agent is a virus.

71. The method of claim 70, wherein the virus is selected from the group consisting of Retroviridae, Picornaviridae, Calciviridae, Togaviridae, Flaviridae, Coronaviridae, Rhabdoviridae, Filoviridae, Paramyxoviridae, Orthomyxoviridae, Bungaviridae, Arenaviridae, Reoviridae, Birnaviridae, Hepadnaviridae, Parvoviridae, Papovaviridae, Adenoviridae, Herpesviridae, Poxviridae, and Iridoviridae.

72. The method of claim 70, wherein the virus is selected from the group consisting of influenza virus, human immunodeficiency virus, and herpes simplex virus.

73. The method of claim 69, wherein the agent is a bacteria.

74. The method of claim 73, wherein the bacteria is selected from the group consisting of *Helicobacter pyloris, Borelia burgdorferi, Legionella pneumophilia, Mycobacteria tuberculosis, Mycobacteria. avium, Mycobacteria intracellulare, Mycobacteria kansaii, Mycobacteria gordonae, Mycobacteria* sporozoites, *Staphylococcus aureus, Neisseria gonorrhoeae, Neisseria meningitidis, Listeria monocytogenes, Streptococcus pyogene, Streptococcus agalactiae, Streptococcus faecalis, Streptococcus bovis, Streptococcus pneumoniae*, pathogenic *Campylobacter* sporozoites, *Enterococcus* sporozoites, *Haemophilus influenzae, Bacillus antracis, Corynebacterium diphtheriae, Corynebacterium* sporozoites, *Erysipelothrix rhusiopathiae, Clostridium perfringens, Clostridium tetani, Enterobacter aerogenes, Klebsiella pneumoniae, Pasturella multocida, Bacteroides* sporozoites, *Fusobacterium nucleatum, Streptobacillus moniliformis, Treponema pallidium, Treponema pertenue, Leptospira*, and *Actinomyces israelli.*

75. The method of claim 73, wherein the bacteria is a mycobacteria.

76. The method of claim 69, wherein the agent is a parasite.

77. The method of claim 74, wherein the parasite is selected from the group consisting of *Plasmodium falciparum, Plasmodium yoelli,* and *Toxoplasma gondii.*

78. The method of claim 76, wherein the parasite is a malaria parasite.

79. The method of claim 69, wherein the agent is an infectious fungi.

80. The method of claim 79, wherein the infectious fungi is selected from the group consisting of *Cryptococcus neoformans, Histoplasma capsulatum, Coccidioides immitis, Blastomyces dermatitidis, Chlamydia trachomatis, Candida albicans.*

81. The method of claim 69, wherein the agent is a cancer.

82. The method of claim 81, wherein the cancer is selected from the group consisting of cancers of the brain, cancers of the lung, cancers of the ovary, cancers of the breast, cancers of the prostate, cancers of the colon, and cancers of the blood.

83. The method of claim 69, wherein the agent is an allergen.

84. The method of claim 73, wherein the allergen causes an allergic condition selected from the group consisting of eczema, allergic rhinitis, allergic coryza, hay fever, bronchial asthma, urticaria (hives), and food allergies.

85. The method of claim 69, wherein the patient was exposed to the agent prior to the disruption of sex steroid-mediated signaling in the patient.

86. The method of claim 69, wherein the patient was not exposed to the agent prior to the disruption of sex steroid-mediated signaling in the patient.

87. The method of claim 56, further comprising administering at least one cytokine, at least one growth factor, or a combination of at least one cytokine and at least one growth factor to the patient.

88. The method of claim 87, wherein the cytokine is selected from the group consisting of Interleukin 2 (IL-2), Interleukin 7 (IL-7), Interleukin 15 (IL-15), stem cell factor (SCF), and combinations thereof.

89. The method of claim 87, wherein the growth factor is selected from the group consisting of members of the epithelial growth factor family, members of the fibroblast growth factor family, Stem Cell Factor (SCF), granulocyte colony stimulating factor (G-CSF), keratinocyte growth factor (KGF), granulocyte-macrophage colony stimulating factor (GM-CSF), and combinations thereof.

90. The method of claim 88, wherein the growth factor is selected from the group consisting of members of the epithelial growth factor family, members of the fibroblast

growth factor family, Stem Cell Factor (SCF), granulocyte colony stimulating factor (G-CSF), keratinocyte growth factor (KGF), granulocyte-macrophage colony stimulating factor (GM-CSF), and combinations thereof.

91. A method of increasing the functionality of immune cells of a patient, comprising disruption of sex steroid-mediated signaling in the patient, wherein said immune cell functionality is increased without, prior to, or concurrently with, reactivation of the patient's thymus.

92. A method for preventing disease or illness in a patient, comprising disruption of sex steroid-mediated signaling in the patient, wherein the functionality of the patient's immune cells is increased without, prior to, or concurrently with, thymus reactivation, and wherein clinical symptoms of the disease or illness are reduced as compared to those symptoms that would have otherwise occurred in a patient prior to disruption of sex steroid-mediated signaling in the patient.

93. The method of claim 91 or 92, wherein said immune cells are selected from the group consisting of T cells, B cells, and dendritic cells.

94. The method of claim 93, wherein said immune cells are T cells.

95. The method of claim 91 or 92, wherein the sex steroid-mediated signaling is disrupted by castration.

96. The method of claim 95, wherein the sex steroid-mediated signaling is disrupted by surgical castration.

97. The method of claim 96, wherein the sex steroid-mediated signaling is disrupted by chemical castration.

98. The method of claim 91 or 92, wherein the sex steroid-mediated signaling is disrupted by administration of one or more pharmaceuticals.

99. The method of claim 98, wherein the one or more pharmaceuticals is selected from the group consisting of LHRH agonists, LHRH antagonists, anti-LHRH vaccines, anti-androgens, anti-estrogens, SERMs, SARMs, SPRMs, ERDs, aromas inhibitors, anti-progestogens, and combinations thereof.

100. The method of claim 99, wherein the LHRH agonists are selected from the group consisting of Eulexin, Goserelin, Leuprolide, Dioxalan derivatives, Triptorelin, Meterelin, Buserelin, Histrelin, Nafarelin, Lutrelin, Leuprorelin, Deslorelin, Cystorelin, Decapeptyl, Gonadorelin, and combinations thereof.

101. The method of claim 99, wherein the LHRH antagonists are selected from the group consisting of Abarelix, Cetrorelix, and combinations thereof.

102. The method of claim 99, wherein the anti-androgen is Cosudex®.

103. The method of claim 91 or 92, wherein the thymus of the patient has been at least in part atrophied.

104. The method of claim 103, wherein the patient has a disease or illness that at least in part atrophied the thymus of the patient.

105. The method of claim 103, wherein the patient has had a treatment of a disease or illness that at least in part atrophied the thymus of the patient.

106. The method of claim 105, wherein the treatment is immunosuppression, chemotherapy, or radiation treatment.

107. The method of claim 103, wherein the patient is post-pubertal.

108. The method of claim 104, further comprising administering cells to the patient, wherein the cells are stem cells, progenitor cells, or combinations thereof.

109. The method of claim 108, wherein the stem cells are selected from the group consisting of HSC, epithelial stem cells, and combinations thereof.

110. The method of claim 108, wherein the progenitor cells are selected from the group consisting of lymphoid progenitor cells, myeloid progenitor cells, and combinations thereof.

111. The method of claim 109, wherein the progenitor cells are selected from the group consisting of lymphoid progenitor cells, myeloid progenitor cells, and combinations thereof.

112. The method of claim 109, wherein the cells are HSC.

113. The method of claim 112, wherein the HSC are CD34+.

114. The method of claim 112, wherein the HSC are autologous.

115. The method of claim 112, wherein the HSC are not autologous.

116. The method of claim 112, wherein the HSC are administered at the time disruption of sex steroid-mediated signaling is begun.

117. The method of claim 102, wherein the disease or illness is caused by an agent selected from the group consisting of viruses, bacteria, fungi, parasites, prions, cancers, allergens, asthma-inducing agents, and self proteins and antigens which cause autoimmune disease.

118. The method of claim 117, wherein the agent is a virus.

119. The method of claim 118, wherein the virus is selected from the group consisting of Retroviridae, Picornaviridae, Calciviridae, Togaviridae, Flaviridae, Coronaviridae, Rhabdoviridae, Filoviridae, Paramyxoviridae, Orthomyxoviridae, Bungaviridae, Arenaviridae, Reoviridae, Birnaviridae, Hepadnaviridae, Parvoviridae, Papovaviridae, Adenoviridae, Herpesviridae, Poxviridae, and Iridoviridae.

120. The method of claim 28, wherein the virus is selected from the group consisting of influenza virus, human immunodeficiency virus, and herpes simplex virus.

121. The method of claim 117, wherein the agent is a bacteria.

122. The method of claim 121, wherein the bacteria is selected from the group consisting of *Helicobacter pyloris*, *Borelia burgdorferi*, *Legionella pneumophilia*, *Mycobacteria tuberculosis*, *Mycobacteria. avium*, *Mycobacteria intracellulare*, *Mycobacteria kansaii*, *Mycobacteria gordonae*, *Mycobacteria* sporozoites, *Staphylococcus aureus*, *Neisseria gonorrhoeae*, *Neisseria meningitidis*, *Listeria monocytogenes*, *Streptococcus pyogene*, *Streptococcus agalactiae*, *Streptococcus faecalis*, *Streptococcus bovis*, *Streptococcus pneumoniae*, pathogenic *Campylobacter* sporozoites, *Enterococcus* sporozoites, *Haemophilus influenzae*, *Bacillus antracis*, *Corynebacterium diphtheriae*, *Corynebacterium* sporozoites, *Erysipelothrix rhusiopathiae*, *Clostridium perfringens*, *Clostridium tetani*, *Enterobacter aerogenes*, *Klebsiella pneumoniae*, *Pasturella multocida*, *Bacteroides* sporozoites, *Fusobacterium nucleatum*, *Streptobacillus moniliformis*, *Treponema pallidium*, *Treponema pertenue*, *Leptospira*, and *Actinomyces israelli*.

123. The method of claim 121, wherein the bacteria is a mycobacteria.

124. The method of claim 117, wherein the agent is a parasite.

125. The method of claim 122, wherein the parasite is selected from the group consisting of *Plasmodium falciparum*, *Plasmodium yoelli*, and *Toxoplasma gondii*.

126. The method of claim 124, wherein the parasite is a malaria parasite.

127. The method of claim 117, wherein the agent is an infectious fungi.

128. The method of claim 127, wherein the infectious fungi is selected from the group consisting of *Cryptococcus neoformans*, *Histoplasma capsulatum*, *Coccidioides immitis*, *Blastomyces dermatitidis*, *Chlamydia trachomatis*, and *Candida albicans*.

129. The method of claim 117, wherein the agent is a cancer.

130. The method of claim 129, wherein the cancer is selected from the group consisting of cancers of the brain, cancers of the lung, cancers of the ovary, cancers of the breast, cancers of the prostate, cancers of the colon, and cancers of the blood.

131. The method of claim 117, wherein the agent is an allergen.

132. The method of claim 121, wherein the allergen causes an allergic condition selected from the group consisting of eczema, allergic rhinitis, allergic coryza, hay fever, bronchial asthma, urticaria (hives), and food allergies.

133. The method of claim 117, wherein the patient was exposed to the agent prior to the disruption of sex steroid-mediated signaling in the patient.

134. The method of claim 117, wherein the patient was not exposed to the agent prior to the disruption of sex steroid-mediated signaling in the patient.

135. The method of claim 98, further comprising administering at least one cytokine, at least one growth factor, or a combination of at least one cytokine and at least one growth factor to the patient.

136. The method of claim 135, wherein the cytokine is selected from the group consisting of Interleukin 2 (IL-2), Interleukin 7 (IL-7), Interleukin 15 (IL-15), stem cell factor (SCF), and combinations thereof.

137. The method of claim 135, wherein the growth factor is selected from the group consisting of members of the epithelial growth factor family, members of the fibroblast growth factor family, Stem Cell Factor (SCF), granulocyte colony stimulating factor (G-

CSF), keratinocyte growth factor (KGF), granulocyte-macrophage colony stimulating factor (GM-CSF), and combinations thereof.

138. The method of claim 136, wherein the growth factor is selected from the group consisting of members of the epithelial growth factor family, members of the fibroblast growth factor family, Stem Cell Factor (SCF), granulocyte colony stimulating factor (G-CSF), keratinocyte growth factor (KGF), granulocyte-macrophage colony stimulating factor (GM-CSF), and combinations thereof.

139. A method for improving an immune response to a vaccine antigen in a patient, comprising:

disrupting sex steroid-mediated signaling in the patient, wherein the functionality of the bone marrow of the patient is increased without, prior to, or concurrently with, reactivation of the patient's thymus; and

administering a vaccine to the patient, the vaccine comprising a vaccine antigen,

wherein the patient develops an immune response to the vaccine antigen, which is improved compared to that immune response which would have otherwise occurred in a patient without disruption of sex steroid signaling.

140. A method for genetically altering a patient comprising:

disrupting sex steroid-mediated signaling in the patient, wherein the functionality of the bone marrow of the patient is increased without, prior to, or concurrently with, reactivation of the patient's thymus;

genetically modifying cells *in vitro* wherein the cells are selected from the group consisting of stem cells, progenitor cells, and combinations thereof; and

administering the genetically modified cells to the patient;

wherein the patient is genetically modified.

141. A method of preventing or treating human immunodeficiency virus infection in a patient comprising:

depleting immune cells of the patient

disrupting sex steroid-mediated signaling in the patient, wherein the functionality of the bone marrow of the patient is increased without, prior to, or concurrently with, reactivation of the patient's thymus;

genetically modifying cells *in vitro* with a gene that inhibits infection, replication or function of human immunodeficiency virus, wherein the cells are selected from the group consisting of stem cells, progenitor cells, and combinations thereof; and

administering the genetically modified cells to the patient;

wherein the human immunodeficiency virus infection is prevented or treated.

142. A method for treating autoimmune disease in a patient comprising:

depleting immune cells of the patient; and

disrupting sex steroid-mediated signaling in the patient, wherein the functionality of the bone marrow of the patient is increased without, prior to, or concurrently with, reactivation of the patient's thymus,

wherein the patient has an improved prognosis for the autoimmune disease compared to an untreated patient suffering from an autoimmune disease.

143. A method for treating an allergy in a patient comprising:

depleting immune cells in the patient; and

disrupting sex steroid-mediated signaling in the patient, wherein the functionality of the bone marrow of the patient is increased without, prior to, or concurrently with, reactivation of the patient's thymus,

wherein the treated patient has an improved prognosis compared to an untreated patient.

144. A method for improving an immune response to a vaccine antigen in a patient, comprising:

disrupting sex steroid-mediated signaling in the patient, wherein the functionality of the bone marrow of the patient is increased without, prior to, or concurrently with, reactivation of the patient's thymus,

administering a vaccine to the patient, the vaccine comprising a vaccine antigen,

wherein the patient develops an immune response to the vaccine antigen, which is improved compared to that immune response that would have otherwise occurred in a patient without disruption of sex steroid signaling.

145. A method for improving an immune response to a vaccine antigen in a patient, comprising:

disrupting sex steroid-mediated signaling in the patient;

administering HSC to the patient;

allowing HSC engraftment in the patient's bone marrow, wherein the HSC engraftment is enhanced without, prior to, or concurrently with thymus reactivation; and

administering a vaccine to the patient, the vaccine comprising a vaccine antigen,

wherein patient develops and immune response to the vaccine antigen, which is improved compared to that immune response that would have otherwise occurred in a patient without disruption of sex steroid signaling.

146. A method for genetically altering a patient comprising:

disrupting sex steroid-mediated signaling in the patient;

administering HSC to the patient;

allowing HSC engraftment in the patient's bone marrow;

genetically modifying cells *in vitro* wherein the cells are selected from the group consisting of stem cells, progenitor cells, and combinations thereof; and

administering the genetically modified cells to the patient;

wherein the HSC engraftment is enhanced without, prior to, or concurrently with thymus reactivation, and.

147. A method of preventing or treating human immunodeficiency virus infection in a patient comprising:

depleting immune cells of the patient;

disrupting sex steroid-mediated signaling in the patient;

administering HSC to the patient;

allowing HSC engraftment in the patient's bone marrow;

genetically modifying cells *in vitro* with a gene that inhibits infection, replication or function of human immunodeficiency virus, wherein the cells are selected from the group consisting of stem cells, progenitor cells, and combinations thereof; and

administering the genetically modified cells to the patient,

wherein the HSC engraftment is enhanced without, prior to, or concurrently with thymus reactivation, and

148. A method for treating autoimmune disease in a patient comprising:

depleting immune cells in the patient;

disrupting sex steroid-mediated signaling in the patient;

administering HSC to the patient;

allowing HSC engraftment in the patient's bone marrow;

wherein the HSC engraftment is enhanced without, prior to, or concurrently with thymus reactivation, and wherein the patient has an improved prognosis for the autoimmune disease compared to an untreated patient suffering from an autoimmune disease.

149. A method for treating an allergy in a patient comprising:

depleting immune cells in the patient;

disrupting sex steroid-mediated signaling in the patient;

administering HSC to the patient;

allowing HSC engraftment in the patient's bone marrow;

wherein the HSC engraftment is enhanced without, prior to, or concurrently with thymus reactivation, and wherein the treated patient has an improved prognosis compared to an untreated patient.

150. A method for improving an immune response to a vaccine antigen in a patient, comprising:

disrupting sex steroid-mediated signaling in the patient, wherein the functionality of the immune cells of the patient is increased without, prior to, or concurrently with, reactivation of the patient's thymus; and

administering a vaccine to the patient, the vaccine comprising a vaccine antigen,

wherein the patient develops an immune response to the vaccine antigen.

151. A method for genetically altering a patient comprising:

disrupting sex steroid-mediated signaling in the patient, wherein the functionality of the immune cells of the patient is increased without, prior to, or concurrently with, reactivation of the patient's thymus;

genetically modifying cells *in vitro,* wherein the cells are selected from the group consisting of stem cells, progenitor cells, and combinations thereof; and

administering the genetically modified cells to the patient;

wherein the immune response of the patient to the vaccine antigen is improved.

152. A method of preventing or treating human immunodeficiency virus infection in a patient comprising:

depleting immune cells of the patient

disrupting sex steroid-mediated signaling in the patient, wherein the functionality of the immune cells of the patient is increased without, prior to, or concurrently with, reactivation of the patient's thymus;

genetically modifying cells *in vitro* with a gene that inhibits infection, replication or function of human immunodeficiency virus, wherein the cells are selected from the group consisting of stem cells, progenitor cells, and combinations thereof; and

administering the genetically modified cells to the patient;

wherein human immunodeficiency virus infection in the patient is prevented or treated.

153. A method for treating autoimmune disease in a patient comprising:

depleting immune cells in the patient; and

disrupting sex steroid-mediated signaling in the patient, wherein the functionality of the immune cells of the patient is increased without, prior to, or concurrently with, reactivation of the patient's thymus,

wherein the patient has an improved prognosis for the autoimmune disease compared to an untreated patient suffering from an autoimmune disease.

154. A method for treating an allergy in a patient comprising:

depleting immune cells in the patient; and

disrupting sex steroid-mediated signaling in the patient, wherein the functionality of the immune cells of the patient is increased without, prior to, or concurrently with, reactivation of the patient's thymus,

wherein the treated patient has an improved prognosis compared to an untreated patient.